Vol. 12.] 1941. [No. 2.

IMP. INST. ENT.
LIBRARY
24 JUL 1941
Aus. 20

AGRICULTURAL JOURNAL

Issued by the
Department of Agriculture, Fiji.

PRICE, ONE SHILLING.

BY AUTHORITY: F. W. SMITH, GOVERNMENT PRINTER, SUVA
1941.

DEPARTMENT OF AGRICULTURE.

STAFF LIST.

ADMINISTRATIVE AND CLERICAL DIVISION—

Administrative Section—

Director of Agriculture	Hon. H. W. Jack, O.B.E., B.A., D.Sc., M.L.C.

Clerical Section—

Grade A Clerk	J. S. Rennie.
Grade B Clerk	O. H. Stanley, A.C.A. (Aust.).
,,	E. L. P. Bradnam.
,,	Miss T. Marr.
,,	Miss L. Duncan.
Probationer Clerk	Miss M. W. Green.

VETERINARY AND FISHERIES DIVISION—

Senior Veterinary Officer	C. R. Turbet, B.V.Sc., M.R.C.V.S.
Veterinary Officer, Suva	H. T. B. Hall, B.V.Sc.
Veterinary Officer, West	R. N. Sanders, B.V.Sc.
Stock Inspector	C. H. Köster.

CHEMICAL AND ANALYTICAL DIVISION—

Senior Chemist, Government Analyst and Assayer	W. J. Blackie, M.Sc., F.I.C., F.N.Z.I.C. (Mem. Soc. Pub. Analysts).
Chemist, Assistant Government Analyst & Assayer	P. R. Charlton, B.Sc., A.N.Z.I.C.
Laboratory Assistant	G. F. Flemons, A.I.C. (seconded to Bermuda).

BIOLOGICAL DIVISION—

Entomologist	R. J. A. W. Lever, B.Sc., (Hons.), D.I.C., A.I.C.T.A., F.L.S.
Botanist and Mycologist	B. E. V. Parham, M.A. (conjoint).

FIELD AGRICULTURAL AND PRODUCE INSPECTION DIVISION—

Field Agricultural Section—

Senior Agricultural Officer	C. Harvey, B.Sc. (Agr)., A.I.C.T.A.
Agricultural Officers	R. Johns, N.D.A., C.D.A., C.D.D., A.I.C.T.A. (seconded to Solomons).
	H. R. Surridge, A.R.C.Sc. (I), B.Sc.
	B. E. V. Parham, M.A. (Hons.).
	D. A. Donald, H.D.A.
	L. W. Harwood, H.D.A.
	M. D. ffrench-Mullen, D.I.C.T.A.
Agricultural Assistants	S. E. H. Coster (conjoint.).
	W. L. Parham.
	J. J. C. Suckling (Dip. Dairying).
	L. H. Dietrich.
Indian Field Assistant	C. J. Dass.

Produce Inspection Section—

Produce Inspector	A. B. Ackland, E.D.
Assistant Produce Inspector	S. E. H. Coster.

LIBRARY AND PUBLICATIONS DIVISION—

Librarian and Editor of *Agricultural Journal* and *Annual Bulletin*	R. J. A. W. Lever, F.L.S. (conjoint).

BANANA LICENCE BOARD.

Director of Agriculture (Chairman).

Produce Inspector. L. C. Bentley. J. A. Garnett. J. S. Rennie (Secretary).

CONTENTS.

VOLUME 12, NO. 2, JUNE, 1941.

* Tables omitted from March issue and so entire article reprinted here.

OLD ISSUES OF AGRICULTURAL BULLETINS.

FREE copies of the following Bulletins are available to Colonial Departments of Agriculture, research institutes and bona fide planters, etc.

No.

1. Sisal Hemp in Fiji, 1911.
3. Rhinoceros Beetle in Samoa, 1912.
4. The Banana in Fiji, 1912.
5. Scale Insect on Bananas, 1913.
6. Lemon Grass, 1913.
7. A Mission to Java for a Coleopterous Pest of Bananas, 1914.
8. Coconut Experiments, 1915.
9. Soils of Fiji—I., 1916.
10. Fijian Plant Names, 1918.
11. Alluvial Soils of Fiji, 1919.
12. Leaf Moth of Coconuts, 1919.
13. Sea Island Cotton, 1920.
14. Transparent Coconut Scale, 1921.
15. Purple Leaf Moth of Coconuts, 1924.
17. Early Nutfall in Coconuts, 1930.
18. Control of Coconut Spike Moth, 1935
19. Fruit Fly Investigations, 1936.

Also, unnumbered, The Mosquitoes of Fiji, 1935.

Applications should be made to the Librarian, Department of Agriculture, Suva, Fiji.

AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 12.] JUNE, 1941. [No. 2.

EDITORIAL.

ONE of the most important agricultural matters in any Colony is the training of the natives for settlement on their lands. In this issue an article on this subject shows that steps have been taken in the last few years to provide agricultural education for selected Fijians, in order to fit them for farming life. The system of training given at the recently established General Experimental Station at Sigatoka and subsequently at the Central Agricultural Station, Naduruloulou, and at the Nasinu Agricultural Station is found to give good results. Similar educational efforts are in operation by the Colonial Sugar Refining Company and the missions and the combined results should prove cumulative and much benefit should accrue to the Colony in the course of time.

The hurricane which struck Viti Levu towards the end of February did not do as much damage to crops as was anticipated, yet it caused heavy losses in the Rewa delta, particularly to tapioca, breadfruit and sugar cane. Fortunately, rice, dalo, yams and sweet potatoes made a quick recovery and food shortage was only acute in a few areas where steps were taken to provide relief. The additional food plantings made as part of the local war effort proved useful, and notes in this issue stress the need for safeguarding food crops in the hurricane season and for growing more of those crops which can be stored, yams and rice in particular.

An interesting article on the potential use of maize and hulled wheat as a substitute for rice is of practical importance. The possibilities of storing wheat as a reserve food supply in war time was considered shortly after the beginning of hostilities, but owing to the lack of storage facilities, the matter was abandoned. Some wheat obtained experimentally was, however, milled into meal for making wholemeal bread, but while the experiment proved that excellent bread could be made at the local goal, it also proved uneconomic compared with the direct importation of wholemeal. At the same time the Director of Education initiated an experiment in feeding whole boiled wheat to school boys. The boys consumed the boiled wheat with relish, with apparently beneficial results in their standard of health. Similarly, the boys developed a liking for maize porridge, as indicated in the notes contained in this issue. The experiments described, especially in regard to locally grown maize, are worthy of imitation by schools and other institutions in the Colony, particularly in the vicinity of good maize-growing areas, and it is hoped that this short article will be studied carefully.

The conclusion of an article by the Medical Officer of Health on the control of mosquitoes is most appropriate and most householders who suffer from the attentions of these vexatious pests could profitably look to such unsuspected breeding places as fern houses, bird and animal drinking troughs and bamboo fences. Control of mosquitoes away from houses requires more planning, but the pruning of trees, draining and periodical oiling of

swampy lands, coupled with the clearing of bush and undergrowth soon reduce the abundance of these pests and thus add much to one's general comfort.

Among the Entomological Notes is information about a small Egyptian egg parasite which has been introduced into Fiji through the good offices of the Government Entomologist of New South Wales. A notice recently inserted in the local press invited anyone whose garden suffered from the green vegetable bug to send fresh egg-masses to the Entomologist to have them parasitised and returned to the owner for release of the ensuing parasites. Another note in this series deals with the army worm, which is usually a pest of rice or Para grass after any exceptionally heavy rainfall such as commonly occurs between February and June. The use of a poison bait usually controls these caterpillars, if it can be applied early enough, this being dependant on early reporting of the pest.

The question of top dressing pastures is constantly engaging the attention of the grazier. An observation test made in the wet zone at Tailevu shows that the growth of grass is more stimulated by the application of coral sand or lime than of superphosphate. This indicates that the land is lime-hungry and it is hoped that local stock-keepers will endeavour to correct this lack on their pastures as soon as may be parcticable.

The Nasinu Agricultural Station aims at supplying the horticultural needs of the Colony, and in this connexion a list of plants and seeds available there should appeal to local gardeners.

An article of practical utility on the treatment of " Kauvula " timber in order to avoid or reduce staining, should prove of value to local timber interests.

The deliberations of the Copra Conference recently held in Sydney were also published in the local press, but as finalisation of the Pool recommendations is not yet possible, no details can yet be included in this *Journal*.

At the Royal Empire Show recently held in Sydney, Fiji was represented for the first time. Owing to lack of space in this issue, it is not possible to add a note on the Show, but the recent publication of a letter written by the Government Agent in Sydney amply indicates that the Fiji exhibit was attractive and creditable and proved a good advertisement to the Colony.

AGRICULTURAL EDUCATION OF FIJIANS.

By
H. W. JACK, O.B.E., D.Sc., B.A.
Director of Agriculture.

AGRICULTURAL education is, to-day, acknowledged to be fundamental to the sound development and continuing progress of the Colonies and the purpose of this note is to review the position of agricultural education in Fiji at the present time.

There has been a definite demand by the people of the Colony for agricultural education such as is usually provided by an agricultural college established on the lines of such colleges in Australia, England, Trinidad and elsewhere. Though such a college would ultimately be highly desirable, it is considered that the average Fijian still lacks sufficient general education to make full use of such an institution, which usually caters for students who have had a good preliminary training in elementary science subjects.

Until such a basic preliminary schooling can be made available—and its obvious need is felt in several Government Departments—agricultural training is better restricted to the purely practical aspect of acquainting youths how to make a moderate living on the land. During the past few years, this aspect of agricultural training has made considerable progress in the Colony, not only at the instance of Government, but by the Missions and the Colonial Sugar Refining Company Ltd.

Within the limitations of the means at its disposal, it is the policy of the Department of Agriculture to provide the best possible facilities for training young Fijians and others in the principles of agricultural practice and animal husbandry.

The General Experimental Station at Sigatoka has now been developed as the main agricultural training centre of the Department. At this station field agricultural experiments are designed to give occular demonstration in the best methods of agriculture—with particular reference to the small holder—who will, it is believed, rapidly become the mainstay of agriculture in the Colony.

The Station is eminently suited to its triple purpose of agricultural education, field research and demonstration because of the variety of crops grown, together with facilities for training in animal husbandry embracing cattle, dairying, pigs, horses and poultry. Particular attention is also paid to crop rotation, soil conservation and the use of composts and other manures in the maintenance and improvement of soils.

The full development of the station has only been possible since early 1938, when funds were made available to purchase the necessary land and to begin the general layout of the plots. In 1939 the erection of most of the required buildings, including superintendent's quarters, Indian Instructor's quarters, students' dormitories, kitchen and mess room, barn, workshop, Indian labour lines, water supply, tank and sports field was completed.

Thirty students, representative of most Provinces of the Colony, were carefully selected and went into residence in January, 1939. The students receive general administrative instruction through a Senior Native Field Assistant, who in turn receives his instructions directly from the Farm Superintendent.

While the majority of the students will return to farm their own lands after the completion of their three year course of training, the best of them will be selected to fill occasional vacancies on the staff of Agricultural, Forestry and other allied Government Departments.

The general scheme of instruction for students embraces two years at the General Experimental Station, which is situated in the dry zone, followed by a final year at the Central Agricultural Station Naduruloulou or at Nasinu Agricultural Station, both these being situated in the wet zone of Viti Levu and providing for training in crops typical of the wet zone, viz. bananas, yaqona, coconuts, coffee, rubber, cocoa, etc.

The students perform all the ordinary work of the Experimental Stations and thus gain a thorough practical training in all branches of agriculture and animal husbandry, which is supplemented by frequent lectures and demonstrations on special aspects of their training.

During their studentship period, the students are provided with working clothes and pocket money (10s. per month), and they are well fed on a good and balanced native diet which, coupled with regular hours and plenty of exercise, has a rapid and marked effect on the improvement of their physique.

The syllabus of instruction is intensely practical and covers the principles and practice of general agriculture as applied to all local food and money crops, horticulture and fruit growing, general animal husbandry and the maintenance of pastures and permanent trees. Also, methods for the conservation of soil, including anti-soil erosion works, maintenance of soil fertility, the use of cover crops and green manures, crop rotation, compost making and manuring, fodder grasses and plants; the use of farm implements, the handling and economic treatment of all classes of farm stock, dairying, butter and ghee making, carpentry and smithy work as normally required on the farm, fencing, concrete work, housebuilding, elementary sanitation and drainage and the repair of implements, etc.

The full complement of students at present in training is 57 (Sigatoka 33, Nasinu 10, Central Agricultural Station 14) and it is hoped that this number may gradually be increased as funds become available for additional dormitories.

In addition to agricultural training directly under the control of the Department of Agriculture, four Provinces maintain small training farms for their own selected pupils.

These training farms, situated at Bua, Kadavu, Labasa and Savu Savu, are controlled by the Provincial Authorities with the advice of the officers of the Department of Agriculture. In all, there are 70 pupils in residence at these farms and the students are able to supplement their knowledge of food crop or subsistence farming as practised in their own homes with experience of crop raising on a wider basis combined with poultry keeping and some animal husbandry, and the use of common farm implements.

Selected trainees from these provincial farms are given opportunities of completing their training on Departmental Stations and one Province also subsidizes pupils for training at the Central Agricultural Station, in addition to Departmentally selected pupils.

The Department of Agriculture also maintains six sub-stations where occular demonstration of farm practices within the scope of the peasant farmer is in progress, such as the use of working stock and draught implements, diversification and rotation of crops, anti-erosion methods, manufacture of composts and pen manure, pasture improvement, water control, planting of timber, fruit and other economic trees, etc. Some of these substations have developed very usefully and are steadily coming to be regarded as centres of farming effort amongst Fijians in the Districts in which they are situated, with stimulating results. Many Fijians visit these substations.

Also, under agricultural training, mention may be made of four Fijian settlement schemes which are supervised by the Department of Agriculture. These comprise 92 peasant farmers and most of them have shown sound progress and are now well established, as indicated by abundance of food, some money crops, plantings of fruit and permanent crops, the purchase of working stock, implements and poultry and improved housing. The majority have paid their rents regularly and many have Savings Bank accounts, while two of the Settlements have built their own schools and maintain them adequately.

Much attention has been given to farming activities at Provincial and District Schools, since these institutions provide opportuinties of interseting and influencing future farmers at an early age. Advice given has related to crop rotations, contour farming, the improvement of live stock and the provision of planting materials, etc.

In addition to educational methods already indicated, much instruction of a practical nature is given by the field staff of the Department during

their tours of inspection. Amongst Fijians, advice and instruction has concerned the maintenance of an abundance of food crops, the cultivation of fresh vegetables and fruits, the planting and care of bananas, maize, rice, pineapples, coffee, etc., sanitation in relation to housing, the care of poultry and advances for the purchase of livestock and implements. Indian farmers are mainly advised in connection with the growing or marketing of rice, tobacco, cotton and root crops to supplement rice, while seed and planting material are sometimes distributed.

Pamphlets are prepared on selected subjects by officers of the Department and circulated in Fijian and Hindi as well as in English, and have proved useful in stimulating cultivation of various crops. Articles are also submitted to the local vernacular press.

In addition to the educational activities briefly outlined above, the Schools and various Missions perform useful work in training students in general agricultural practice and to produce their own main foods.

Recently the Colonial Sugar Refining Company established a training farm for some 80 boys, where students are receiving a sound training designed to turn them into good sugar cane farmers, and reports indicate that this farm is performing a very useful function.

The demand for agricultural training in Fiji is evident from the number of applications that are made for membership of any of the above-mentioned training institutions and, while it is not yet possible to indicate what proportion of agriculturally trained students prove successful farmers, there can be no doubt of the cumulative value of such training to the Colony.

All education requires appreciable capital and recurrent expenditure, but, considering the limitations of funds for agricultural training in Fiji, fair headway would seem to have been made in the past few years.

Agricultural education cannot afford to be static and if the maximum benefits are to accrue, continuity of effort along every possible line of advance must be assured.

It is hoped that these notes will indicate that agricultural education in Fiji is not being neglected, though it must be admitted that there is much room for improvement and development as our resources permits.

FOOD CROPS AND THE 1941 HURRICANE.

By
C. HARVEY, B.Sc., A.I.T.C.A.,
Senior Agricultural Officer.

Reports from Agricultural Officers indicate that the general food position in native areas was not adversely affected by the February hurricane to the extent that was anticipated on receiving the first reports. This is largely due to the fact that the hurricane was characterized in most areas by the absence of general and prolonged flooding. Most damage observed was directly due to the action of high winds; much more extensive damage has been experienced in the past when wind of less force was accompanied, or immediately followed by, deep flooding and a prolonged period of water-logging of the soil. There are, however, local shortages in certain localities, particularly the Rewa delta, where fields were inundated with salt water with losses of all root crops in consequence. The heavy rains of April have also retarded planting and development in low-lying fields of kumalas, the most useful early maturing crop for planting after losses have occurred.

Of the root crops, dalo appeared to suffer only when mature or nearly so in exposed situations, when decay of the root may follow the severe twisting of the leaf stems. Only a small proportion of the crop was affected and young to half-grown plants recovered very quickly. Supplies are plentiful, partly due to increased plantings during the war period, and there is no likelihood of a general shortage such as followed the 1939 storms.

Tapioca suffered most of any of the root crops, as plants half-grown or more present a large surface to the wind. The overturning or breaking off of the above ground part of the plant frequently ruptures the root and rot sets in. Sometimes woodiness sufficient to render the root unfit for eating may result from violent disturbance even though the plant has apparently recovered; this applies also to the other root crops. Such damage was extensive, though it is often not apparent until the crop is dug. However, large areas of this crop had been planted and later plantings appear to have recovered fully.

Kumalas were not much affected, except where flooded or washed out.

Yams suffered very little damage, being usually planted on well-drained land above the flood limit, but low-lying fields in the Rewa delta were inundated. The loss was only partial as the crop was generally mature.

The breadfruit crop was an almost total loss in many localities, though in sheltered situations some fruit remains on the trees, Many trees were blown over.

Rice was early reported to have suffered extensive damage, but this proved to be largely unfounded. In the Navua area it is unlikely that the total loss will exceed five per cent of the crop. Early-planted rice in flower at the time of the hurricane failed to set seed and rice of advanced maturity was laid. However, only a small proportion of the crop had reached this stage and the young rice has fully recovered. Scorching of young rice by wind-blown sea spray proved only a very temporary setback. Localized damage has resulted from inundation by sea water following damage to bunds.

Mature and three-quarter grown maize was laid, but maize up to four feet high generally escaped.

In the case of root crops, Fijians were often energetic in salving their crops. Immediately before the onset and during the early part of the storm, many were out pruning back half to full grown tapioca so as to minimize damage. This was, however, more commonly carried out after the storm, thus enabling younger plants to make early recovery, though mainly ineffective for mature crops. Damaged mature tapioca was dug for immediate consumption wherever possible, but only from some areas of Lomaiviti was it reported that Fijians had utilized their surplus of windblown tapioca and breadfruit by burying it in pits lined with leaves and covered with earth, a common storage practice before baker's bread, rice and the ubiquitous tinned salmon was introduced.

Greater reliance on home grown foodstuffs, which has been consistently advocated as a war time measure, is dependent on regularity of supply which again depends on regular planting throughout the year or on the storage of seasonal crops. The periodic visitations of hurricanes emphasise the importance of maintaining reserves of native bulk foods, either in the ground or in the storehouse. Dalo, tapioca, and kumalas are all liable to widespread damage under flood conditions, and none can be dug and stored effectively as, under the prevailing humid conditions, the storage of tapioca and kumalas as dried chips or flour, as in dry climates, is largely impracticable. Tapioca can be stored in the ground, i.e. it can be left and dug only as required, but in such condition is liable to total loss in case of

storms or flood. The lesson is that although the bottom lands are usually the most productive, Fijian individuals and communities should make the best use also of land above flood level wherever such is available and wherever soils suitable for dalo, kumalas or tapioca occur. It is also essential to maintain small regular successive plantings of these crops; mature crops are most vulnerable to storm damage, whereas young crops often escape wind damage and may quickly come forward to shorten the hungry period following a disaster. Where no high ground is available, Fijians might well give more attention to rice planting to supplement, though not to displace, their normal root plantings.

The only root crop capable of lengthy house storage under local conditions is the yam in its many varieties, and this crop deserves wider interest than is the case at present. Although its planting is restricted to a definite season of the year, it is probable that the limits could be extended to some degree, and, in any case, it can be stored in good condition for many months. As pointed out above, it is usually grown on well-drained soil above flood level, and is less seriously affected by storms than other root crops. At the present time it is also a useful cash crop, selling at from 7s. to 9s. per cwt. in Suva, where it is in strong demand. It is, however, primarily as a root crop for emergency storage that the yam deserves more attention.

NOTE BY DIRECTOR OF AGRICULTURE.

In this connexion it is advisable that much greater plantings of the yam should be envisaged in the future. In these days a reserve supply of essential foodstuffs should be held by all producers so that, should any emergency arise, producers may not only have sufficient food for their own families, but a surplus for sale to those who have no facilities for growing foodstuffs. It is hoped that yam planting may be extended considerably in the coming planting season, so that it may become possible to build up a reserve supply in due course. —H.W.J.

A PRELIMINARY INVESTIGATION OF BLUE STAIN IN "KAUVULA" TIMBER.

By
J. L. DESPEISSIS,
Assist. Conservator of Forests.

THE following preliminary investigations of the staining of the timber known as kauvula (*Endospermum* spp.) were made possible through the courtesy of Messrs. Millers Limited of Suva, who manufacture boxes, particularly butterboxes, from this wood. The butterbox trade is most exacting in its requirements as boxes must be free from taint and clean in appearance. Unfortunately *kauvula* suffers from two faults: first, an odour, which can however, be eliminated by steaming; and second, a susceptibility to attack by staining fungi which cannot be overcome quite so simply.

Fungal stains vary in colour and origin. Surface moulds may be green, brown, yellow and even black, but are all purely superficial, do not penetrate the wood and may be removed by planing. There is another group of fungi, which penetrates deep into timber and destroys it. These fungi produce stains, but are always associated with decay or breakdown of wood structure. Fortunately, reasonable care in seasoning methods eliminates this group from the timber yard. Lastly, there are fungi sometimes known as " sap-staining " fungi on account of their preference for sapwood with its high starch and sugar content. However, due to the rapid growth of some

of the softer timbers here in the tropics, there is not always the same distinction between sap and truewood as would be the case in more temperate regions; so consequently in many cases the whole of a tree is susceptible to attack. A bluish discolouration is the most common result of infection by these fungi which are thus generally known as " blue-staining " fungi. These fungi penetrate the wood but do not cause decay or effect its mechanical properties. They produce a stain, which cannot be removed by surfacing and these stains are caused by several genera of fungi. Under Australian conditions it is known that several species of *Ceratosomella* cause blue stain while in America species of *Penicillium* are responsible for stain.

Timber which has a moisture content of less than 20 per cent of its dry weight, is safe from attack by blue-staining fungi. Air-dry timber has normally a moisture content of approximately 15 per cent and is, consequently, immune from attack. The dangerous period, therefore, is while seasoning is still in progress. There are two methods of protecting timber during this period: either it may be dried quickly by artificial means under conditions which are not favourable to growth of fungi, or else it may be given chemical treatment to protect it during the normal air-seasoning period. Kiln drying is the practical application of the first method and dipping in 3 to 5 per cent borax solution is an effective chemical treatment in the second method. It is possible, by temperature control during kiln seasoning to eliminate the danger of attack. The borax treatment should not be necessary with kiln drying. By comparing the procedure in use here with methods which have proved successful in the control of blue staining elsewhere, it is hoped that a suitable technique for the treatment of *kauvula* may be evolved. The following notes were made with the hope that they might be of assistance in this respect.

Messrs. Millers Limited recently installed a kiln at their Walu Bay Timber Yard with the object, primarily, of steaming the timber in order to deodorize it and, secondly, of speeding up seasoning. Treatment of timber offsaws with cold solution of 5 per cent borax for several seconds has been made standard practice. This is a combination of the two methods quoted above. The treatment is giving fairly satisfactory results but, in spite of this, blue staining does still occur to some extent.

Six sample boards were selected for observation from a stack of freshly sawn 13 inches x 1 inch *kauvula* boards about to be put into the kiln for seasoning. The logs from which these boards were sawn had been delivered to the mill freshly cut so that the " offsaws " weight recorded here may be accepted as true " green " weights. (See table 2).

In an endeavour to eliminate any tree-to-tree variation, the six sample boards were selected in pairs, each pair being derived from a different log and each log from a different tree.

The sample boards were weighed to the nearest half pound. Three of them were then dipped into an open trough containing 5 per cent borax solution for approximately one minute, while three were left untreated. The six boards were then put into the kiln with the remainder of the charge and distributed throughout the stack.

The charge remained in the kiln for seven days, during which time it was subjected to steam at approximately 200°F. for 24 hours and hot air at approximately 150°F. for 32 hours. The plant operates only during normal working hours and is shut down at night.

On being taken from the kiln the sample boards were weighed again. The whole charge was stacked in the open to air-dry for ten days. The sample boards were then placed separately under cover and weighed again twenty-four days later.

Before the boards were placed in the kiln, and before they were weighed for the first time, samples were taken for an oven dry weight determination. From the figures so obtained, the average moisture content of green *kauvula* was found to be 83 per cent of its oven dry weight. From these figures, the oven dry weight of each board was calculated, and hence the moisture content (per cent) on removal from the kiln (on 11th July, 1940), and after 34 days air seasoning (on 14th August, 1940), was determined. (See table 1.)

Reference to table 2, shows that the six sample boards together lost 82½ lb during the seven days in the kiln and only 6 lb during the subsequent 34 days air-drying. This would appear to indicate satisfactory drying, until it is noticed that the loss of 6 lb is entirely from boards Nos. 1, 2 and 3 but more particularly from Nos. 1 and 2. The remainder were practically air-dry when removed from the kiln. This indicates either a lack of uniformity of conditions within the kiln or else a variation of physical characteristics between individual trees. The latter possibility may be discounted by the fact that sample board No. 4 does not share this loss with its partner No. 3 and further by the fact that boards Nos. 1 and 2 were placed in the centre of the charge. Uneven conditions within the stack, due to faulty air circulation, almost certainly, therefore, account for these slight variations. After 34 days air-drying, however, the irregularities largely disappeared; the average moisture content being 16·6 per cent, and after an additional twelve days as low as 13·3 per cent, of the dry weight.

Recent improvements to the kiln and the longer period of treatment of the present test, as compared with previous practice, indicate that the kiln is now effective from a seasoning point of view, whereas it is doubtful if previously this was the case. In spite, however, of the improvement in the drying capacity of the kiln, blue-staining fungi still develop under the existing conditions of operation. From an inspection of the sample boards, it is obvious that the borax treatment does largely prevent blue-stain attack. Sample boards Nos. 2, 4 and 6 showed blue staining, while the treated boards were quite clean. Borax, therefore, is still necessary under the present conditions.

Fungi attacking timber need certain suitable conditions of temperature and moisture for their development. A temperature of 130°F. at 100 per cent relative humidity sustained for several hours is effective in sterilizing nfected timber up to 4 inches x 4 inches sizes, while 150°F. at 100 per cent. relative humidity for nine hours will effectively sterilize timber up to 9 inches x 9 inches. Air-dry timber is immune from attack by blue-staining fungi and therefore if infection is to be prevented, it is essential to maintain temperatures of 130°F. and over, until the moisture content falls below the limiting moisture content of 20 per cent.

These investigations reveal, therefore, no less than three alternative methods of improving on the performance of the original kiln. Firstly, by improving the ventilation and by maintaining the temperature continuously above the minimum described above, it should be possible to reduce the seasoning period by half and simultaneously to remove all chance of blue stain developing: in the particular circumstances under discussion, however, this is in the nature of a counsel of perfection as the small volume of business involved in the manufacture of butter-boxes does not warrant the additional expense.

Secondly, by continuing to dip timber in borax solution and by retaining the kiln and working schedule as it stands a reasonable degree of immunity from blue stain is obtained: this is, obviously, the most economic practice at present since it achieves its object with the minimum of additional expense.

There is, however, a third method which remains to be tried and which may prove to be cheaper than either of the first two. It is, apparently, the humid conditions brought about by the preliminary steaming, particularly when the temperature falls overnight, which encourage, rather than retard, the fungal development. If the steaming process is relegated to a later stage, that it to say if the present process is reversed, conditions inimical to the growth of staining fungi might be brought about. The suggestion therefore, is first to dry the timber below a moisture content of 20 per cent—thus destroying the fungi—and subsequently to steam it for the purpose of removing the odour. It is unlikely that the steaming period, so long as it is not unnecessarily prolonged, will raise the moisture content to a prohibitive level in which case a final drying for a few hours will once more remove the water absorbed during steaming. Experiments along these lines might well prove profitable. It will be observed that this suggestion involves no alteration to the kiln and very little change in the existing procedure: it does, however, offer possibilities of saving both as to the cost of borax and the labour employed in dipping.

TABLE 1.

No. sample board.	Weights lb 4/7/40.	Moisture per cent from oven dried sample.	Calculated oven dry weight. $=\frac{\text{wt. of board.} \times 100}{100 + \text{Moist. \%}}$	Moisture content % at any time $=\frac{\text{wt. at time—Oven dry wt.} \times 100}{\text{Oven dry weight.}}$		
				Moisture content after kiln drying 11/7/40.	After air drying 14/8/40.	After air drying 26/8/40.
	lb	per cent	lb	per cent	per cent	per cent
1	36	79	20·1	29·4	14·4	11·9
2	37	98	18·7	31·0	20·4	14·9
3	49	84	26·6	20·3	16·5	12·8
4	44	81	24·3	15·2	15·2	13·2
5	39	68	23·2	14·2	14·2	12·1
6	39·5	88	21·0	19·1	19·1	17·0
Average	..	83	....	21·5	16·6	13·3

TABLE 2.

No. sample board.	Average dimensions 4.7.40.	Vol. Cubic feet.	Weights lb.				Weights in lb per cubic foot.			
			Before kiln 4.7.40	After kiln 11.7.40	After air drying 14.8.40	After air drying 26.8.40	4.7.40	11.7.40	14.8.40	26.8.40
1	10′ 8″ x 13″x 1″	0·96	36	26	23	22·5	37·5	27·1	24·0	22·4
2	10′ 9½″x 13″x 1″	0·97	37	24·5	22·5	21·5	38·1	25·3	23·2	22·2
3	13′10½″x 13″x 1″	1·25	49	32	31	30	39·2	25·6	24·8	24·0
4	12′ 5½″x 13″x 1″	1·12	44	28	28	27·5	39·3	25·0	25·0	24·6
5	10′10½″x 13″x 1″	0·98	39	26·5	26·5	26	39·8	27·0	27·0	26·4
6	10′11½″x 13″x 1″	0·99	39·5	25	25	24·5	39·9	25·3	25·3	24·7
Total		..	244·5	162	156	152	..	..	..	..
Differences lb		..	82·5	6	4	..	..	..	..	..
Average per cubic foot		..	..	..	..	..	39·0	25·9	24·9	24·1

PREVENTIVE MEASURES AGAINST MOSQUITOES.

Part II.

By
G. R. BAXTER, M.D., D.P.H., Medical Officer of Health, Suva.

PREVENTION OF DOMESTIC BREEDING PLACES—*Continued.*

(*f*) *Fern Houses.*

Suva has a weakness for fern houses—and they are usually shady and damp places. Plates with ferns on containing water, frequently breed larvæ. One of my first visits in Suva was to a house where I was shown round the garden and the fernery. I saw four different places literally alive with larvæ all under the noses of the occupants, who were quite oblivious of their existence, and yet they complained bitterly about the "plague" of mosquitoes.

(*g*) *Garden Ponds.*

These need very careful watching and stocking with small fish, otherwise they will certainly breed. It is useful to note that tadpoles do not eat mosquito larvæ and both can often be found in the same pool.

(*h*) *Bird Baths.*

Large shells or any sort of contrivance used for ornamental bird baths are dangerous, especially when the occupants are away from home for some time. The water should be changed at least weekly.

(*i*) *Poultry Runs.*

Water receptacles in these are often let in to the ground and are favourite places in which to find mosquito larvæ. All receptacles should be such as can be completely overturned and emptied at least weekly.

(*j*) *Water Filters.*

Domestic water filters (candle type) occasionally contain larvæ—when the lid gets broken or chipped, or if the inner receptacle does not fit well on the outer one. They are frequently left open when occupants go away.

(*k*) *Bird Cages.*

I have found larvæ in water pots in parrot and canary cages—here again these are particularly dangerous when occupants go away as these receptacles are quite overlooked.

(*l*) *Various.*

When premises are vacated every care must be taken to empty and put upside down all flower vases and common water receptacles. Unused W.C. cisterns will breed larvæ—and also the W.C. pedestal in an empty house. I have known the water in the trap of a bath breed larvæ and fill the house with mosquitoes which greeted the occupants when they returned from a somewhat lengthy absence. Don't forget to plug the bath waste when you go away.

The following places are also important and concern the occupants of premises, but are "structural" in character, or perhaps concern rural districts more than towns.

(1) *Roof Gutters.*

These are common breeding places. The channels frequently get obstructed with leaves or the gutters sag in places and hold water for long after the rains. They are favourite places for *Stegomyia*—the black and white silent, day-time mosquitoes.

It is interesting to note that, following an outbreak of yellow fever in Bathurst, Gambia, the authorities ordered every roof gutter in the town to be demolished—the first step they took in mosquito control to get rid of these deadly pests.

Gutters should be cleaned out and examined about every three months.

(2) *Water Tanks.*

These must be screened, i.e. provided with tight-fitting lids. An important point also is that an overflow pipe is necessary and this should be screened with gauze, or mosquitoes will enter the tank and breed. I have actually had drinking water which contained mosquito larvæ served in a "first class" hotel. I have also actually seen mosquito larvæ in milk sold in Suva, obviously from dirty cans, which had been washed out with water containing larvæ from unprotected wells or tanks.

Cisterns used in connexion with hot water systems can be a dangerous source of larvæ and like water tanks they should be screened and protected, again not forgetting the overflow.

(3) *Wells.*

If the water-level is not too far down these will often breed larvæ. The remedy is a proper lid to exclude mosquitoes. The wells can be stocked with small fish or a little kerosene or liquid paraffin can occasionally be used and will not affect the taste of the water if left for a little while.

(4) *Septic Tanks.*

These are specially favourite breeding grounds for Culex mosquitoes which will infest the adjacent house and neighbourhood. The vent must be screened with gauze—and no inlet must be open to mosquitoes. Any drain receiving effluent from a septic tank must be kept clear and carefully watched for breeding. New septic tanks are often left open during construction and breed mosquitoes prolifically.

(5) *Pit Latrines.*

These are also favourite places for breeding *Culex* mosquitoes which will infest the nearby dwellings. During heavy rains water may get in, or the water level may rise with the ground water. About a cigarette tin full of old oil can be poured down occasionally to prevent breeding. If your house is infested with *Culex* mosquitoes—the ones which "ping" or hum—you can be certain that there is a faulty septic tank, a faulty pit latrine, or a foul drain within a short distance.

(6) *Bamboo Fences.*

These must be quite *tabu* unless the bamboos are split. They are frequent unsuspected breeding places. An instance is the Reservoir Look-out at Tamavua, and Navua abounds in them.

(7) *Bottles.*

Inverted bottles are sometimes used for lining paths, and broken bottles may be used on the tops of walls. Both require careful watching to see that water is not retained.

(8) *Culverts and Garages.*

If there is a garage approach over a culvert across the roadside drain the culvert should be inspected occasionally as they frequently get blocked and can hold water for considerable periods and being dark they are excellent and common breeding places. Garages, incidentally, also being dark, are favourite places for mosquitoes, and if infested, the car should be "flitted" when taken out each morning, and a search made for the breeding places of the mosquitoes.

Gully traps under sink or kitchen wastes will also breed them when undisturbed as in empty premises.

(9) *Native Drums or Lalis.*

These are favourite breeding places and they are found in nearly every village. One alone would breed sufficient mosquitoes to infest a whole village and there is no doubt that these assist in the spread of elephantiasis in outlying islands. There is no reason why they should retain water at all.

Boilers for boiling clothes, and water troughs in laundries are often forgotten when the house is left empty.

(10) *Punts, Small Sailing Boats, Lighters, etc.*

These often contain rain-water, especially when "high and dry". Sea water should be used if water is necessary to prevent warped timbers due to drying. Small boats can be overturned.

4.—Prevention of Non-Domestic Breeding Places.

Some kinds of trees are notoriously bad. Large holes frequently contain water for long after the rains, and even when there is no rain. Heavy dews will maintain water in tree holes for a considerable time. Holes can be filled with stones and earth, and tarred or cemented over. Sometimes a V-shaped cut will enable water to be drained away or holes may be bored for this purpose.

The most notorious mosquito breeding trees are the clumps of large thick bamboos; the beautiful "flame" or flamboyant trees, especially when old; and the ivi trees in Fiji are also bad. Cut paw-paw trunks are hollow and can hold considerable water. Other known mosquito breeding plants are sisal and via *Alocasia* and allied plants with broad boat-shaped leaves.

In gardens, clumps of *Heliconia* (or lobster claw) and Pandanus are frequent unsuspected offenders. Thick shrubs and dense climbers should be avoided near the walls of your home or under the windows. Thick creepers like "purple leaf" maintain the ground underneath them very damp and offer shelter for adult mosquitoes. A good shake with a walking stick in the dusk of the evening will reveal how these plants harbour insects of all kinds.

(2) *Plantations.*

Banana plantations are usually heavily infested due to fallen leaves holding water.

Coconut plantations are notorious breeding places due to split husks lying about and holding rain.

(3) *Grazing Pastures in Swampy Ground.*

Anyone who has seen the oxen ploughing in rice fields can have no doubt about the large holes which can be left by cattle. In pasture land these depressions fill up with water mixed with washings of manure—an ideal

medium for *Culex* larvæ and these breeding places must not be overlooked and forgotten. Areas affected can be dealt with by scattering broadcast sawdust which has been soaked in old engine oil. This is very effective as quite large tracts can be dealt with and it is effective over quite a long period of time, since the oiled sawdust remains when puddles, etc., dry up, and is effective again when the next rain comes.

Incidentally, it is possible for any collection of water, especially if containing decaying vegetable matter, to breed both *Stegomyia* and *Culex* mosquitoes. I know of no recorded instance in which all three kinds of mosquitoes, (*Anopheles*, *Culex* and *Stegomyia*) have been found in the same collection of water which is rather an interesting fact.

The following methods are those chiefly used for dealing with large mosquito breeding areas:—

(4) *Pools and Streams.*

(*a*) Oiling pools by spraying oil over them, the oil should be applied sparingly, the film should be just thick enough to give a display of colours, as seen when orange peel is squashed in a puddle. The tendency is to waste oil. Oil acts by blocking the breathing tubes of the larvæ and because of this it is effective against both larvæ and pupæ. Poison powders like paris-green, which are scattered broadcast on large pools are only effective against the larvæ which actually eat and swallow the poison. Pupæ do not eat and so these poisons do not kill pupæ. This is an important practical point.

(*b*) Streams can be oiled by "drip cans" dropping oil on the water as it passes under the cans. The object is to have oil on the water when it reaches the lower levels and where it is slower moving, and where it may lodge in pools, etc., which would breed mosquitoes. They are extremely effective and can save considerable labour costs which would be expended on constantly treating the larger channels further downstream.

(*c*) Large ponds which cannot be reached by spraying can be oiled by sinking in the middle of them a weighted sack full of sawdust of shavings soaked in oil.

(5) *Swamps and Flat Country.*

(*a*) *Drainage.*

Drainage is important for swampy areas as an efficient drain will often render large tracts free from breeding. The importance of drains following contour lines instead of crossing them is stressed, as much larger areas are "tapped" in this way. There are many methods—open drains, subsoil agricultural drains, rubble drains, dutch drains and open concrete channels. Earth drains require constant clearing and regrading or they themselves may become breeding places. They should be straight and preferably V-shaped in section.

(*b*) *Filling.*

This is often the best means, especially in low, flat areas where "falls" of level are difficult to obtain.

(*c*) *Clearing of Bush and Overgrowth.*

This is extremely important as an anti-mosquito measure. Tins and bottles are exposed, swampy areas revealed, the sun is allowed to get at the ground and dry it up and adult mosquitoes can no longer use it as a hiding or resting place.

Clearing, draining and filling are not only remedies against mosquitoes but are also efficient against the so-called sand flies of Fiji (*Culicoides*).

In conclusion the way to tackle the domestic mosquito problem is to start at your own house and to eliminate the possible breeding places inside the house and then in your own garden and grounds. You will be surprised at the places you can find. The public should support the authorities in anti-mosquito work in the towns and large centres.

People who (by their neglect) permit their neighbours to be plagued with mosquitoes deserve to be punished, just as people are punished if they allow accummulations of rubbish, etc., which may cause a district to be infested with flies or rats.

People should acquaint the Health Authorities of undue prevalence of mosquitoes so that a proper search can be made. They should not be annoyed if larvæ are discovered on their premises, but thankful that the place has been found out.

The public should be just as keen to keep the town free from mosquitoes as they are to have clean and tidy streets. In short, the people must become "mosquito-conscious" and insist on these dangerous pests being kept under proper control. This co-operation of the public is essential, but there is also the indisputable fact that if people in a town have to pay even only 5s. every time mosquito larvæ are found on their premises, that it will not be long before the town is mosquito free; this, in my opinion, is one of the best ways of impressing upon the public the real seriousness of the mosquito menace.

ENTOMOLOGICAL NOTES.

By

R. J. A. W. LEVER, B.Sc., (Hons.), D.I.C., A.I.C.T.A., F.L.S.

1. EGG PARASITE OF THE GREEN VEGETABLE BUG.

When dealing with the first recorded appearance in Fiji of the green vegetable bug (*Nezara viridula* L.) last June the writer mentioned (1) that an egg-parasite which is exercising some control in New South Wales, might be introduced here for the same purpose.

Through the courtesy of the Government Entomologist in that state, a shipment of *Nezara* eggs parasitised by this tiny wasp (*Microphanurus basalis* Woll.) was received in Suva in the middle of March. Stocks of the host had previously been collected and bred but were very scarce in Suva owing to their main food plants (tomato and beans) having been destroyed by the hurricane of February 20th (gale force reached 110 m.p.h.).

Eggs were, however, at last obtained and mass breeding was then begun, the developmental period of the parasite varied from 8½ to 11 days, with an average of 10·4 days. Owing to Defence Regulations it is not now permissible to publish current meteorological data but records of the last five years show that 79·6°F. is the average mean temperature for April. This compares favourably with Australian observations where (2) at a temperature of 30°C. (85°F.) the average life-cycle of the parasite was 10·27 days. The insect measures one-twelfth of an inch in length and is easily reared on drops of honey. The genus *Microphanurus* is widely distributed, being recorded from *Nezara* eggs as far afield as Egypt, Italian Somaliland, the West Indies and Florida. Although said (3) to have been introduced from Egypt to Western Australia and from there to southern Queensland in 1933, it was not, apparently, introduced into Australia until 1934.

Colonies have been liberated at Sigatoka, Suva, Navuso and Nadarivatu and the following notice was published in the local newspaper on 25th April:—

> "Persons whose garden plants are being damaged by the green vegetable bug (*Nezara*) may have parasites supplied free, on application to the Department of Agriculture. Recently laid egg-masses of this bug should be sent, with name and address enclosed, to the Entomologist who will have them parasitised for subsequent liberation by senders in their own gardens. It is necessary to send only recently laid eggs which are pale yellow in colour; orange or reddish ones are useless. The eggs occur in masses on the lower leaf surface of tomato, bean and other plants."

It is of interest to note that the proposal to introduce *Microphanurus basalis* into the Solomon Islands was referred to the writer in March, 1940, and a consignment was duly received from Sydney in May of that year. It is found to prefer the eggs of the shield-bug *Axiagastus campbelli* Dist. to those of the more destructive coconut pest, *Amblypelta cocophaga* China.

The writer is indebted to the Agricultural Officer, Western, for sending supplies of *Nezara* to replenish the stock in Suva.

REFERENCES.

(1) Lever, R. J. A. W.—1940. *Agric. Journ.*, Fiji, Vol. 11, No. 2. June.
(2) Noble, N. S.—1937. *Agric. Gaz.*, N.S.W. June 1st.
(3) Smith, J. H.—1938. Rept. Dept. Agric and Stock, Queensland.

---

2. THE CABBAGE WHITE BUTTERFLY IN AUSTRALIA.

Although the cabbage white (*Pieris rapæ* L.) has been in New Zealand since 1930, it was not till 1939 that it reached Australia, spreading from Victoria to New South Wales in May 1940 (1). Early this year a specimen was taken in Sydney and as this is a notorious long-flying butterfly it is likely to increase its range very rapidly.

While we in Fiji have been fortunate enough not to have had this unwanted introduction in the eleven years since the butterfly has been in New Zealand, the new position calls for additional inspection by the Produce Inspection Division. Australian imports of cabbage and cauliflower have had to be stopped.

A previous note by the writer (2) mentioned the record of a female cabbage white at the Suva reclamation by the former Entomologist. The correct date for this potential invader was June, 1931; fortunately it has not been recorded since.

While it is hoped that we shall be free from this pest, if any readers should find a velvety green caterpillar on cabbage they should at once communicate with the Entomologist, as early reporting of any pest is the best method of wiping it out The butterfly is white with black markings on the wing-tips and the male has one black spot on each forewing and the female two.

There are two local butterflies which might be mistaken for *Pieris*, one is a species of *Callidryas* which, though it has black wing tips and spots on the forewings, is a delicate lemon in colour; the other is *Catopsilla pyranthe* L. which is white but lacks any black markings.

REFERENCES.

(1) *Agric. Gaz.*, N.S.W.—1941. April.
(2) Lever, R. J. A. W.—1939. *Agric. Journ.*, Fiji, Vol. 10, No. 2.

3. BEETLE PEST OF PULSE.

In the *Journal* for last March reference was made (1) to three pea and bean "weevils" of the genus *Bruchus* which were attacking cowpea and broad beans. In November last some specimens of dhall, sent by the District Commissioner, Western, from Lautoka—besides being damaged by the corn ear worm—had the seeds in the pods bored by one of these beetles. This was identified as *Bruchus chinensis* L., known already (2) in Fiji as a pest of the following pulses:—

Phaseolus adenanthus G. Meyer; *P. calcaratus* Roxb., rice bean; *P. semierectus* L.; *Vigna catiang* Wulp., cowpea and *Cicer arietinum* L. Bengal gram.

The damage done at Lautoka to the seeds of dhall was said to be severe enough to check Indians planting this crop: the variety grown is known as "arhar" or pigeon pea, botanically *Cajanus cajan* (L.).

The control methods recommended were as follows:—

Early harvesting of crop; fumigation with carbon bisulphide, 4 lb. for every 1,000 cubic feet or, if this is impossible, soaking the seeds for five minutes in a mixture of two parts boiling water to one part of cold water and sowing only uninfected seed next season. For storing, it was suggested that two inches of bone-dry, fine coral sand should be placed on the top layer of seeds in the drum, tank or barrel; this dries up the body-fluids of the insects and so checks development among the seeds.

The pea and bean weevil *B. obtectus* has since been taken at Suva wharf in beans from California and *B. quadrimaculatus* F. in *Crotalaria* pods from Florida but all of the latter were destroyed on arrival.

REFERENCES.

(1) Lever, R. J. A. W.—1940, *Agricultural Journal*, Fiji, Vol. 11, No. 1.
(2) Veitch, R. and Greenwood, W. T.—1921, *Proc. Linn. Soc.* N.S.W., Vol. 46, Pt. 4.

---

4. INTRODUCED BENEFICIAL INSECTS.

In 1932, Simmonds published a very useful list (1) of parasites introduced into Fiji for controlling harmful insects. Since that date the following beneficial insects have been specially imported and released in the Colony and are given together here for reference:—

Name.	Host (pest).	Country of origin.	Date liberated.
1. *Pleurotropis parvulus* Ferr. ..	*Promecotheca reichei* ..	Java ..	May, 1933.
2. *Cremastus* sp.	*Nacoleia octasema* Meyr.	Java ..	May, 1933.
3. *Tetrastichus giffardianus* Silv. ..	Fruit-flies	W. Africa ..	April, 1935.
4. *Dirhinus* sp.	Fruit-flies	India ..	March, 1937.
5. *Syntomosphyrum indicum* Silv. ..	Fruit-flies	India ..	March, 1938.
6. *Platylister chinensis* Quens. ..	House-flies	Java ..	Nov., 1938.
7. *Microphanurus basalis* Woll. ..	*Nezara viridula* L. ..	Egypt ..	March, 1941.

Two errors in Simmonds' list mentioned above are corrected here in order to avoid their being perpetuated by future writers. The predatorial wasp *Scolia manilæ* Ashmead, is stated by Simmonds to have arrived from Hawaii in 1914 but Veitch, who actually made the introduction, gives (2) December, 1917 as the date.

The predacious beetle *Plæsius javanus* Er. is recorded by Simmonds as as having been introduced from Java in 1914 but Jepson's paper (3) published early in January of that year makes it clear that this beetle was introduced in September, 1913.

The thrip not given any name (No. 19) is *Aleurodothrips fascipennis* Frankl. and besides the Javanese *Scymnus* sp., the closely related *S. ænipennis* Sic. from Trinidad was also liberated in 1928 (4).

REFERENCES.

(1) Simmonds, H. W.—1932, *Agric. Journ.* Fiji, Vol. 5 No. 1.
(2) Veitch, R.—1921, *Agric. Circ.* Fiji, Vol. 5. No. 1.
(3) Jepson, F. P.—1914, *Bull.* No. 7, Dept of Agric. Fiji.
(4) Taylor, T. H. C.—1935, *Bull. Ent. Resch.* Vol. 26, Pt. 1.

---

5. A CATERPILLAR PEST OF RICE, MAIZE AND SUGAR AND ITS PARASITES.

In June, 1938, damage to rice near Viti Levu Bay was found to be due (1) to attack by the dun-coloured caterpillars of the moth *Cirphis unipuncta* Haw. The injured portions then were the spikes (flower-heads) which were eaten through in a typical cutworm-like manner. Eleven months later (May, 1939) similar damage, but on a larger scale, was found at Tailevu(2) where considerable areas of Para grass were stripped bare by these caterpillars. In August, 1940, a visit to land along the Waimaro—a tributary of the River Waibula—in the same Province, revealed damage to maize by this caterpillar acting, not as a cutworm, but eating the unexpanded leaves.

This type of damage is not to be confused with that of the corn ear worm, *Heliothis armigera* Hbn. which attacked growing maize cobs in October, 1939 (3).

Besides rice, Para grass and maize, *Cirphis* also attacks sugar and is locally called the sugar-cane army worm (4) owing to its destruction to young cane. Although well known elsewhere as a maize pest it was not previously recorded locally from this crop though stated (5) to feed on the leaves of other grasses. From leaf-sheaths of maize at Waimaro the writer collected the white cocoons of the Braconid wasp *Apanteles antipoda* Ash. which had parasitised the caterpillars. The type locality, i.e. place where the specimen described was taken, is Natova (6): the insect is also known from Samoa and may be synonymous with *A. ruficrus* Hal. (7).

For the control of the corn ear-worm or tomato fruit-worm (*Heliothis*) batches of the live adult *Apanteles* were sent to Hawaii in the care of a passenger.

Larval *Cirphis* from the Waidina area were, last August, found to be attacked by *A. samoana* and a third species of this useful parasite is *A. expulsus* Turn. (5) but, despite these three wasp parasites and the Tachinid fly *Sturmia bimaculata* Htg., *Cirphis* is frequently a serious pest.

The writer is obliged to Mr. D. T. Fullaway, Entomologist and Chief Plant Inspector, Honolulu, for kindly determining the various species of the difficult genus *Apanteles*.

Since the above was written, an outbreak of this army worm was reported early in May along the Rewa River. A poison bait—comprising 1 lb of Paris green to 25 lb of bran mixed with 1 quart of molasses moistened with

4 gallons of water—was made up on the spot. As remarked in an earlier note (1), these caterpillar outbreaks usually occur after heavy rain as the following data, from three localities, show. The names in brackets are the nearest places from which meteorological returns are available:—

Viti Levu Bay, June, 1938 ..	Rainfall 3·26 inches.	Average	2·77 inches (Penang).
Wainibokasi, March, 1939 ..	„ 23·06 „	„	14·71 inches (Nausori).
Nacavucavu, May, 1941 ..	„ 37·23 „	„	12·61 inches (Naduruloulou).

Rice was the chief crop attacked in the present instance but Para grass and sugar cane leaves were also damaged.

REFERENCES.

(1) Lever, R. J. A. W.—1938, *Agric. Journal*, Fiji, Vol. 9, No. 3, Sept.
(2) Lever, R. J. A. W.—1939, *Ibid.* Vol. 10, No. 3, Oct.
(3) Lever, R. J. A. W.—1940, *Ibid.* Vol. 11, No. 1, March.
(4) Veitch, R.—1923, *Col. Sug. Ref. Coy., Agric Rpt.* No. 7, December.
(5) Veitch, R. and Greenwood, W.—1921, *Proc Linn. Soc.* N.S.W., Vol. 46, Pt. 4.
(6) Wilkinson, D. S.—1928, *Bull. Entom. Resch.*, Vol. 19, Pt. 2.
(7) Wilkinson, D. S.—1929, *Ibid.* Vol. 20, Pt. 1.

6. SPREAD OF MEGARHINUS MOSQUITO.

In the middle of April a letter was sent by a planter in Mago (Mango) Island accompanying an insect sent for identification. This proved to be the large, metallic mosquito *Megarhinus splendens* Wied. introduced from Java by Mr. R. W. Paine in 1931 and 1932. The interest of the capture of this useful mosquito on Mago is that the spot nearest this island where colonies were liberated was Vanuabalavu (1) so that the insect has in nine or ten years spread over twelve miles of open sea, doubtless aided by the south-east trade wind.

The white eggs are laid by the adult—which is not a blood-sucker—in tree-holes, barrels, old tins and leaf-axils of *Colocasia* ("dalo" and "via") and very rarely in rat-bored coconut husks (2). It is within these receptacles that the voracious larvæ ("wrigglers") devour the larvæ of the filarial mosquito *Aedes variegatus pseudoscutellaris* Theob. against which *Megarhinus* was primarily introduced. One larva, taken by the writer on Taveuni in June 1938 took six weeks to pupate(3) though given an adequate diet of the larvæ of the mosquito mentioned above.

REFERENCES.

(1) Paine, R. W.—1934. *Bull. Entom. Rsch.* Vol. 25, Part 1, March.
(2) Paine, R. W.—1935. Bull. Dept. Agric., Fiji (unnumbered).
(3) Lever, R. J. A. W.—1938. *Agric. Journ.* Fiji, Vol. 9, No. 3, Sept.

7. ECTOPARASITES OF NATIVE BIRDS AND A BAT.

Certain of the two-winged flies have specialised their mode of living by being external parasites in the fur of bats, feathers of birds and fine "down" of bees.

Fijian members of this group of flies were first dealt with by Jepson (1) who referred to four species of Hippoboscid or louse-flies, *Ornithoica pusilla* Schin. from a hawk (*Circus* or *Astur* ?), *Ornithoctona australasiæ* F. from the jungle fowl (*Gallus bankiva*) and two undetermined parasites from a species of parrot (*Prospeia* ?) and a pigeon (*Ducula* or *Columba* ?).

This May the present writer recorded *Myophthisia reduvoides* Rond., another of these flies, from a deserted nest of the cave-dwelling swift (*Colocalia fuciphaga spodiopyga* Peele). This fly has poorly developed wings and emerged from a brown ovoid pupa 4 mm. (one-sixth of an inch) in length.

Thirty years ago Jepson also recorded an unnamed wingless "spider-fly" from the flying fox (*Pteropus tonganus* Quoy and Gaimard). Specimens taken from the fur of this bat by the author in 1938 were identified by the Imperial Institute of Entomology as *Cyclopodia similis* Speiser. Despite their entire loss of wings, these flies move swiftly in the bat's fur and are very elusive.

Finally, specimens of the Hippoboscid *Olfersia spinifera* Leach were kindly brought back by the late Mr. F. H. Rostier from Canton Island (3°S., 172°E.) in the Phœnix Group. As the host was the frigate bird (*Fregata minor*), which also occurs in Fiji, it can be expected that this fly is a member of the local fauna.

---

(1) Jepson, F. P.—1911. Dept. of Agric. Fiji. Council Paper No. 25.

MAIZE AND HULLED WHEAT AS SUBSTITUTES FOR RICE.

By

F. R. J. DAVIES, M.A., Dip.Ed.,

Department of Education, Fiji.

The present shortage and high cost of rice is presenting a problem to institutions unable to substitute native vegetables The Fijian does not take kindly to new foods. Milk, eggs and even rice were slowly adopted. Now is the time for him to discover a very valuable food that seems to have been overlooked. It is surprising that maize which is being grown increasingly and which is the staple food of many Africans and North American Indians, is used here mainly as fowl food or as green cobs. If maize were popularized as a stored food, it is doubtful whether such large quantities of rice would require to be imported. If however, some grain needs to be imported, it may be better to import wheat at a much lower cost and higher nutritive value.

During 1940, wheat could be landed in Fiji at approximately £12 per ton. Maize sells locally at approximately £6 per ton. In March, 1941, rice was difficult to procure even at £27 per ton.

In an institution accommodating approximately 100 Fijian boarders, hulled wheat or dried maize have been used extensively for 18 months as food and standards of health have apparently been raised by their use. Little rice or white bread has been used. There was, at the commencement, the usual suspicion and reluctance to use strange foods, but this has been largely overcome by pointing out that most Europeans live on wheat and use little rice. The Fijian respects the Red Indian and the African native and the knowledge that they gain their strength mainly from maize, helps to overcome the psychological difficulty. He is also interested to know that cornflour is made from maize and that ice creams are made with this ingredient. He is suprised to learn that maize porridge and corn foods are used extensively by Europeans overseas.

HULLED WHEAT.

The easiest method of cooking hulled wheat is to boil it in water for an hour or two in the same way as rice is prepared; salt may be added. The grain should swell and bursts as if insufficiently cooked, the food may prove indigestible.

The best method for Fijian conditions is to use it in the form of wheatmeal porridge. The common machine used for grinding yaqona is quite suitable for making meal, though more primitive methods can be devised. A fine meal is more quickly cooked and is usually preferred though it is not really necessary.

WHEATMEAL PORRIDGE.

For every cup of meal, allow 4 cups of water and a level teaspoonful of salt. Moisten the meal in cold water to prevent lumps forming. Boil the water first and add the salt to it. While the water is still boiling, stir in the meal and continue to stir at intervals to prevent burning. The porridge can be used after a few minute's boiling, but an hour is preferable. Serve the porridge with sugar or molasses and if possible with milk. The above should compare very favourably with ordinary prepared porridges.

BREAD.

If hulled wheat is ground sufficiently fine a very nutritious yet cheap wholemeal bread can be made. Yaqona mills are quite satisfactory for the purpose. Any baker should be content to bake the loaf for 2d. each or less.

MAIZE PORRIDGE.

The same type of mill may be used for grinding maize. Treat the meal as for wheatmeal porridge, save that slightly more maize should be added to the water. To 20 cups of water add 6 cups of maizemeal freshly ground. Boil the water and add one desertspoonful of salt. Then add the meal which should have previously been moistened with cold water. Stir to prevent burning. Boil for approximately an hour. Serve with molasses or sugar and milk. Maizemeal porridge is very similar to other porridges, but actually has more flavour insofar as it still retains the flavour of sweetcorn.

Since maize and rice are grown at different seasons, a larger market may encourage the smallholder to grow two different crops in the year and may give him an opportunity of utilizing two types of land. There is little doubt that polished rice is inferior to maize and it is to be hoped that the Fijian will discover that in maize he has already learnt to grow a food that can be stored and that will tide him over when his root crops are insufficient or immature.

DALO VARIETIES FROM ROTUMA ISLAND.

(*Colocasia esculenta* (L.) Schott.)

By
B. E. V. PARHAM,
Agricultural Officer, South.

In 1939 the Senior Agricultural Officer brought from Rotuma a collection of unidentified dalo varieties, which comprised 52 tops or "matana," representing 31 local names which were given in an accompanying list.

On examination the material was found to comprise two plants of each 24 varieties and one of each of 4 varieties. As two names appeared twice in the list, it was concluded that six plants representing three names were lost in transit.

With a view to determining the identity of the plants and their behaviour under Fijian conditions, the tops were planted in an observation plot at

Central Agricultural Station, Naduruloulou where the study of local dalo varieties has been carried on for the past seven years. Growth was excellent, not a single plant being lost. At suitable intervals the services of a Rotuman native were sought in an effort to correlate the names on the list with the individual plants. In this way nine of the Rotuman names were allotted to their respective plants.

The main object, however, has been to compare the Rotuman plants with local (Fijian) types and in this direction the results are of some interest.

Of the 28 distinct types received, 22 have been identified with local varieties, four are doubtful and only two appear distinguishable from types already in the Station's variety collection.

The following is a list of the varieties under their Fijian names; the Rotuman names, where established, are given in brackets:—

1. Samoa (Samoa); 2. Tausala ni Samoa (Feata); 3. Tausala (Hotnagtesousou); 4. Vavai vula (Makasiaufis); 5. Vavai damu (Makasiaumia); 6. Vavai ni Suva (Toptop); 7. Vesi (Sasa); 8. Oreore (Telfis); 9. Vutikoto; 10. Sikavi damu; 11. Sikavi loa; 12. Sisiwa; 13. Vavai; 14. Vavai loa; 15. Volo damu; 16. Toakula; 17. Volo vula; 18. Qere; 19. Dalo ni wai and 20. Mumu.

The plants of doubtful indentity have been referred to the following two type groups:—1. Tausala, 2. Vavai. The two plants not at present referable to any known local variety are being propagated for further observation.

As a point of interest, it may be noted that of the 28 types, eight are referable to the "Vavai" or "Basaga" group, which is characterized by the branching of the parent corm. These dalo are usually grown under dry land conditions, are early maturing and heavy-yielding and are generally regarded as excellent table varieties.

The "Tausala" group of rhizome-producing dalo is represented by four types, two of which await final determination.

Of the remaining 15 types, 13 are well known in Fiji in areas of upland culture in the wet zone.

Conspicuous by its absence from the collection under consideration is the well-marked and widely distributed variety "Kurokece" (or "Mata me Teri"), but this is not to say that this valuable variety does not occur in Rotuma.

Systematic work of the nature briefly reported in the present note is an essential preliminary to a better knowledge of this important food crop. The large number of varieties under cultivation in the Colony and the great diversity of names by which they are known in different parts necessitate the raising of successive generations of clones over a number of years in order to arrive at a definite basis of selection.

Acknowledgement is made of the careful work of N.F.A. Meli Rokobici in propagating the plants, to Laboratory Assistant Filimone Raiqiso for assistance with field records and to Kafau Tuca of the Navuso Agricultural School for information regarding Rotuman names.

AGRICULTURAL NOTES.

1. PASTURE EXPERIMENT, TAILEVU.

The behaviour of pastures under grazing and their reaction to top dressings are factors influencing the management of farms in the dairying sections of the Colony. One of the problems is the stimulation of growth of hill pastures. The following is an account of observations carried out on a small scale trial of top dressings on a typical hill pasture.

The plots were situated on the farm of Mr. C. C. Sachs, Korovou, of whose continued interest and practical assistance grateful acknowledgment is made. Various officers of the Department of Agriculture were associated in laying out the experiment and in observing and commenting on the results.

The soils of the plots are similar to much of the grazing country of the Tailevu Province, particularly the Korovou section. The country was originally covered with reed and clumps of weed, particularly guava. The farm on which the plots were situated had been under grazing for 30 years. The soil is a red-brown heavy loam of small clod structure, and mechanical analysis shows 61 per cent of silt and 16 per cent clay. Profile development is immature, the soil changing at 9 inches to 18 inches to a red-yellow horizon of clayey texture with compacted structure and poor internal drainage. At from 2 feet 6 inches depth and over the sub-soil passes insensibly into a compacted mudstone. Chemical analysis gives available phosphate 80 parts per million, available potash 50 parts, a total base exchange of 6·31 m.e. per cent, of which only 2·74 m.e. per cent is represented by calcium, a pH of 5·03 and a lime requirement of 3 tons per acre. The above indicates that the soil should respond to lime and phosphate dressings, and also that the physical properties of the soil would be improved by drainage and increased aeration.

The treatments were as follows:—

Lime	1	ton per acre.
Coral sand	5	,,
Farmyard manure	1	,,
Bat guano	1	cwt. per acre.
Basic slag	1½	,,
Superphosphate	1	,,

These dressings were applied to 1/80 acre plots, two plots of each treatment, with four untreated plots as controls. This layout was repeated on a second block which was given a rough shallow ploughing before the dressings were applied.

The area was fenced to keep out stock and the dressings were applied in September, 1939. The whole of each dressing was applied at one time, except in the case of superphosphate, one-half of which was applied in September, 1939, and the balance in June, 1940.

In May, 1940, the plots were examined by the Botanist to ascertain changes, if any, in botanical composition. There was no obvious or significant change as between the various dressings given. As was to be expected, there was a striking change between the block which received top dressings alone and that which was scarified (shallow ploughed) before being top dressed; this is shown by the following analysis:—

Block A. (shallow ploughed)	Block B. (unploughed)
Dominant—	Dominant—
Mimosa pudica (Sensitive Plant).	*Axonopus affinis* (tall Carpet grass)
Lythrum hyssopifolium (Tar weed).	*Crysopogon aciculatus* (Seed grass).

Abundant—
Cassia sp. (Kau moce).

Common—
Desmodium trifolium (Fiji "Clover")

Rare—
Asclepias curassavica
Eleusine indica (Crowsfoot grass).
Paspalum orbiculare (grass).
Echinochloa colonum (grass).

Abundant—
Paspalum conjugatum (Thurston grass).
Desmodium trifolium (Fiji "Clover")

Common—
Mimosa pudica (Sensitive plant).

Rare—
Mikania scandens (Mile-a-Minute).
Lythrum hyssopifolium (Tar Weed).
Jussieua suffruticosa (weed).
Paspalum dilatatum (Paspalum grass).
Eleusine indica (Crowsfoot grass).

It will be seen that the effect of the shallow ploughing was to encourage weed growth, principally Sensitive Plant, to the almost total exclusion of grasses. It is interesting to note that when 38 cows were turned into the experimental paddock (one half-acre in area) in March, 1940, 34 of them grazed for one hour exclusively on the dominant stand of Sensitive Plant on the ploughed block, after which time a very few turned to the unploughed block on which there was a strong growth of typical hill pasture grasses with little Sensitive Plant.

During May and June, 1940, the plots on the unploughed block were cutlassed, and in June mowing with an ordinary lawn-mower was commenced. From June until November the plots were mown at two to three week intervals and the fresh clippings from individual plots weighed separately. The weights of clippings may be taken as being indicative of the rate of growth of grass and are shown in the following tables in which the yields of the plots have been adjusted for ease of comparison so that the mean yield of the untreated (control) plots equals 100. The rank growth of weeds on the ploughed block did not permit of hand mowing.

TABLE I.

Yield of fresh grass in lb per plot from individual plots compared with mean yield of control plots = 100 on either side:—

Superphosphate	(1) *94	(2) 109
Lime	(1) *94	(2) 154
Bat guano	(1) 102	(2) 106
Coral sand	(1) 147	(2) 128
Farmyard manure	(1) 109	(2) 114
Basic slag	(1) 97	(2) 121

* Control on one side only.

TABLE II.

Mean yield of fresh grass in lb per plot of 2 plots of each treatment compared with mean yield of 4 control plots:—

Superphosphate	108
Lime	123
Bat guano	112
Coral sand	145
Farmyard manure	111
Basic slag	102
Control	100

It is emphasized that the layout of the plots was designed for observation only and does not permit of statistical analysis of the yield figures, which, therefore, must not be read as significant. However, the results are strongly indicative that on this type of pastured, the growth of grass is stimulated by applications of coral sand or lime and that this stimulation becomes effective much sooner after the dressing is given than might be expected. The lack of response from superphosphate is disappointing. The results confirm observations from mechanical and chemical analysis of the soil that the principal requirement is the addition of lime (as agricultural lime or coral sand). In the case of this trial, the application of superphosphate was at a low rate, only one cwt. per acre, but there is a probability that the full benefit of fertilizer dressings will not be obtained on these soils until after the lime requirement has been satisfied.

It is proposed to continue observations on the plots, though mowing has been discontinued. It is also proposed to lay down, when circumstances permit, a controlled experiment with a reduced number of treatments and on a layout that will permit of stricter evaluation of results.

—C.H.

2. PLANTING OF RICE VARIETIES.

By
B. RAMNATH,
Indian Assistant, Central Agricultural Station, Naduruloulou.

THE following brief note gives the seasons best suited to the planting of different varieties of padi in the wet zone, together with observations on the periodicity of the crop.

Chetwa is sown in nursery in September, transplanted in October or early November, harvested end of March or April. This variety is known also as " Gagi " this being the name of a man at Dawasamu. " Chetwa " refers to the month in which this variety is harvested.

Rewa Patna, Sereya Patna and *Karia Patna* are sown in October, transplanted in November and December and harvested in May. All are good for planting in wet land, when good yields may be obtained.

Motmuria, sown in October, transplanted in November and December and harvested in May, is a small grain type.

The recently introduced variety *B.G.*79, which is very similar to Sereya Patna has the same cycle as the last named, as has also *B.G.*75 which is the best yielding of all varieties grown in Fiji.

Ramcajara also sown in October and reaped in May is the most popular with Indian farmers who consider it the best variety for food purposes.

China Patna.—Sown in November and December, transplanted in December and January and harvested in June, is characterized by a strong straw in wet land also by good cooking quality.

Motka.—Usually sown in December or January, transplanted January and February and reaped in July gives a medium crop of very heavy grain.

New Guinea and *Sonacalif* may be sown at any time, transplanted after 40 days and reaped after $5\frac{1}{2}$ and $4\frac{1}{2}$ months respectively. The former is good only for wet land where three crops can be harvested in 16 months. The latter may be planted by two methods—one is to drill or broadcast in the field and the other is to sow in the nursery and transplant after 40 days.

PLANTS AND SEEDS LIST, NASINU AGRICULTURAL STATION.

PLANTING material as listed hereunder is available in limited quantities on application to the Agricultural Officer, Nasinu. The propagation of most of these is by seed, usually available throughout the year. Exceptions to this are denoted by the following indicative letters:—

(A) Propagation by seed, but the latter is set very irregularly at Nasinu.

(B) Propagation by cuttings, suckers, tubers, etc.

(C) Plants on budded stocks.

(D) There are no bearing trees at Nasinu, but seedlings are occasionally available.

Delivery.—Seed may be sent through the post, but the despatch of plants, cuttings, etc., to country districts is sometimes difficult. Delivery of the latter will be made to any transport agency in Suva and country orders should be accompanied by instructions as to whom the plants should be delivered.

Charges.—A small charge is made to cover cost of packing, minimum 6d. per packet of seeds and 1s. per bundle of cuttings. Potted seedlings and plants are charged at 1s. each, budded citrus plants at 2s. 6d. Orders from schools and other approved institutions are supplied free of charge.

FRUIT TREES.

	Common Name.	*Botanical name.*
	Rose apple	*Eugenia jambos.*
	Soursop	*Annona muricata.*
	Jak fruit	*Artocarpus integer.*
	Mangosteen	*Garcinia mangostana.*
	Java almond	*Canarium commune.*
	Malay apple	*Eugenia malaccensis.*
(D)	Avocado pear	*Persea americana.*
	Duku	*Lansium domesticum.*
(D)	Sugar apple	*Annona squamosa.*
	Governor plum	*Flacourtia jangomas.*
	Carambola	*Averrhoa carambola.*
(D)	Durian	*Durio zibethinus.*
(D)	Rambai	*Baccaurea motleyana.*
(D)	Custard apple or Sugar apple	*Annona squamosa.*
	Tamarind	*Tamarindus indica.*
(D)	Mango	*Mangifera indica.*
(A)	Litchi	*Litchi chinensis.*
	Sapodilla	*Achras zapota.*
	Surinam cherry	*Eugenia uniflora.*
	Lime berry	*Triphasia trifolia.*
	Cherry guava	*Psidium cattleianum.*
(C)	Citrus—orange, grapefruit, mandarines, limes.	*Citrus* spp.

ECONOMIC PLANTS.

	Coffee, Liberian	*Coffea liberica.*
(D)	Coffee, Arabian	*C. arabica.*
	Cocoa	*Theobroma cacao.*
	Tea	*Camellia sinensis.*
	Rubber	*Hevea brasiliensis.*
	Leprosy oil tree (Chaulmoogra)	*Hydnocarpus anthelminticus.*
(D)	Tung	*Aleurites montana.*
(B)	Camphor	*Cinnamomum camphora.*
(A)	Cinnamon	*C. zeylanicum.*
(A)	Clove	*Eugenia aromatica.*
(D)	Cashew nut	*Anacardium occidentale.*
(B)	Sisal	*Agave sisalana.*
	Dilo	*Calophyllum inophyllum.*
	Rain Tree—white bark	*Acacia* sp.
(D)	Rain Tree—silver bark	*Albizzia moluccana.*
	Rain Tree—(Inga saman)	*Pithecolobium saman.*
	Silky oak	*Grevillea robusta.*
	Teak	*Tectona grandis.*
(B)	Fiddle wood	*Citharexylum spinosum.*
(B)	Mahogany, Large-leaved	*Swietenia macrophylla.*
(B)	Mahogany, Honduras	*S. Mahagoni.*
(D)	Persian lilac	*Melia azedarach.*
	Trincomalee-wood	*Berrya ammonilla.*
	Padouk (yellow shade tree)	*Pterocarpus indicus.*
	Copal	*Trachylobium verrucosum.*
(B)	Padri-tree	*Stereospermum chelonoides.*
(D)	Spotted gum	*Eucalyptus maculata.*
(D)	Dakua salusalu	*Podocarpus vitiensis.*
	Vesi-ni-wai	*Pongamia glabra.*
	Nokonoko	*Casuarina equisetifolia.*
(D)	Yemane	*Gmelina arborea.*
	Sa	*Parinarium insularum.*
	Horse cassia	*Cassia grandis.*
(B)	Pink shower	*C. nodosa.*
(B)	—	*C. javanica.*
(B)	—	*C. siamea.*
(B)	Yellow shower	*C. fistula.*
(B)	Small yellow cassia	*Cassia* sp.
(B)	Golden candle	*C. alata.*
(B)	Yellow cassia—thorny	*Cassia* sp.
(A)	Red bead	*Adenanthera pavonica.*

(A)	African tulip tree	*Spathodea campanulata.*
(A)	Rose of Venezuela	*Brownea grandiceps.*
(A)	Butterfly tree	*Bauhinia purpurea..*
	Pride of Barbados (red) ..	*Caesalpinia pulcherrima.*
(D)	Pride of Barbados (yellow) ..	*Caesalpinia pulcherrima.*
	Flamboyante	*Delonix regia.*
(B)	Queen Flower	*Lagerstroemia flos-reginae.*
(B)	(Yellow Shower)	*Peltophorum ferrugineum.*

PALMS.

Cabbage palm	*Oreodoxa oleracea.*
Royal palm	*O. regia.*
Arecanut	*Areca catechu.*
Traveller's palm	*Ravenala madagascariensis.*
Raphia	*Raphia vinifera.*
Oil palm	*Elaeis guineenis.*
Fan palm	*Livistonia australis.*
—	*Cocos plumosa.*
—	*Phœnix rupicola.*
Dwarf palm	*P. humilis.*
Date palm	*P. dactylifera.*
Sago palm	*Metroxylon vitiensis.*

ORNAMENTAL SHRUBS.

(B)	Hibiscus—various	*Hibiscus rosa-sinensis* vars.
(B)	Crotons—various	*Codiæum* spp.
(B)	Ixora—red, yellow or white ..	*Ixora* spp.
(B)	Reeds—green & white striped	——
(B)	Reeds—dark red.	——
(B)	Dracæna—green or red ..	*Dracæna* spp.
(B)	Duranta	*Duranta repens.*
(B)	Bougainvillea	*Bougainvillea spectabilis.*
(B)	Caladium	*Caladium* spp.
(B)	Poinsettia	*Euphorbia pulcherrima.*
(B)	Canna	*Canna* spp.
(B)	Allamanda	*Allamanda cathartica.*
(B)	Gliricidia	*Gliricidia sepium.*
	Annatto	*Bixa Orellana.*
(B)	Lobster Claw	*Heliconia brasiliensis.*

EPHEMERAL FEVER OF CATTLE.

It is of interest to note the conclusion reached by Mackerras, Mackerras and Burnet in regard to the nature of ephemeral fever of cattle. Their work leading to the conclusion is set out in bulletin No. 136 issued by the Council of Scientific and Industrial Research under the Title " Experimental Studies of Ephemeral Fever in Australian Cattle." Their conclusion is:—

> " We may summarize the results of this survey in the general statement that ephemeral fever is closely related to human dengue, that it is almost certainly insect-borne, that transmission is most probably cyclical, that the vector is probably a sandfly, and that the disease is likely to remain permanently as a recognisable clinical entity in Australia . . . . . "

—C.R.T.

REVIEW.

DISEASES OF THE COCONUT PALM.

Written with the object of giving " in simple English an account of the diseases of the tall coconut palm," this handbook* by the late Professor of Mycology at the Imperial College of Tropical Agriculture has much to recommend it to coconut planters and others concerned with this crop. The principal fungal and physiological diseases to which the palm is subject are discussed; the book is fully illustrated with thirty-seven excellent photographs and one coloured plate.

The first five chapters are devoted to the " bud-rot " complex, with which local planters are familiar, and concerning which the author " feels that there is still much to learn."

This complex is divided into the following separate diseases: (1) bronze leaf wilt, (2) *Phytophthora* bud-rot, (3) tapering stem wilt or pencil point and (4) red ring disease caused by a Nematode worm *Aphelenchus cocophilus* Cobb. None of these are ascribed to bacteria and the doubt is recorded as to whether there is any such thing as primary bacterial bud-rot of palms.

Bronze leaf wilt, recorded in West Indies and Ceylon, is ascribed to unsuitable soil conditions resulting in physiological draught. A chapter of particular interest locally is that dealing with *Phythophthora* bud-rot, caused by the fungus *P. palmivora*, Butler, which also attacks the palmyra and the areca or betel nut palms, and which has been recorded in almost every country where the crop is grown.

False wilt, lightning strike and stem-bleeding disease are dealt with; and the three forms of root diseases caused by the fungi *Ganoderma lucidum*, *Fomes* sp. and *Fomes noxius* are described; these last named are regarded as unimportant diseases of this crop.

The remaining chapters of the book deal with leaf diseases, many of which have been recorded in Fiji, and with gumming disease and dropping of nuts.

A valuable feature of the book is the considerable list of references and the attention which has been given to the economic aspect of control measures which are so often the major factor in scientific plant protection methods in the tropics.

The handbook, which has been excellently produced and profusely illustrated, is welcomed as a valuable addition to the literature on this crop.

—B.E.V.P.

* " The Diseases of the Coconut Palm " by H. R. Briton-Jones revised by E. E. Cheesman, published by Messrs Bailliere, Tindall Cox, London, 1940. Price 10s. 6d.

EXTRACTS.

THE DEPENDENCE OF COPRA AND COCONUT OIL UPON WORLD CONDITIONS.

ESTIMATED world production of oils and fats (oilseed converted into their oil equivalents at source of production) in tons of 2,000 lb:—

Oils and Fats.	*Quantity in tons of* 2,000 lb.
Coconut Oil	2,267,774*
Peanut Oil	1,580,026
Soya Bean Oil	995,141
Cotton Seed Oil	1,708,927
Linseed Oil	1,366,566
Palm Kernel Oil	375,105
Rape Seed Oil	488,709
Hemp Seed Oil	188,002
Sesame Seed Oil	301,430
Kapok Seed Oil	6,876
Sunflower Seed Oil	675,030
Castor Seed Oil	115,196
Babassu Kernel Oil	21,454
Oil Seeds (other)	358,263
Palm Oil	596,937
Olive Oil	862,385
Maize Oil	61,364
Wood Oil	143,725
Butter	3,336,933
Lard	1,508,244
Tallow and Premier Jus	569,843
Fish and Whale Oil	631,764
Animal Fats (other)	421,742

* The total world coconut oil products represents only 12 per cent (approximately) of the oils and fats in the world markets.

—"Coconut Industries," Ceylon, Vol. 4, No. 4, 1940.

—H.W.J.

CONTROL OF WEEVILS IN GRAIN.

CONTROL weevils in bulk stores by:—

1. Thoroughly cleaning out bins, trucks, bags, etc., before putting in fresh grain.
2. Destroying all refuse; don't merely throw it outside.
3. Shaking and turning bags after use and hanging them over a wire instead of piling them on the floor near the old grain.
4. Treating infested bags by dipping in boiling water, white oil (1/60), kerosene emulsion (1/20) or other effective dip, or by dusting with ground quartz.
5. Keep all grain as dry as possible.
6. Do not mix old and new season's grain.

—Jenkins, C. F. H.—1940. *Journal*, Department Agriculture, Western Australia, Vol. 17, No. 4, December.

[Above done with wheat but applicable for rice and maize.]

—R.J.A.W.L.